

Chapter 2

The Watershed

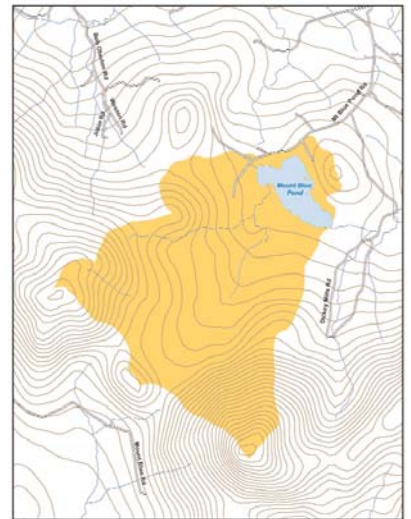
Phosphorus Budget

Lakes can only accept so much phosphorus before a significant decline in water quality occurs. The Maine Department of Environmental Protection has developed phosphorus allocations for several Maine lakes to minimize phosphorus loadings and their impacts to lake water quality.

Lakes are individuals, each one differing from the others with varying size, shape and depth. Specific lake characteristics will affect the way a lake will respond to additions of phosphorus.

The watersheds draining to lakes also vary as they can be large or small relative to lake size and can contribute relatively large or small volumes of stormwater and groundwater to the lake. The watershed can be entirely upland or it may contain a number of upstream lakes and wetlands. It may contain steep slopes and hilly terrain, or be relatively flat. Soils may range from loose sands or gravels to tight clays or shallow tills. Watersheds can range from completely forested to highly agricultural or heavily developed, and may be located in areas ranging from little to rapid growth. These factors, along with the characteristics of the lake itself, determine the potential for increased phosphorus, and hence algae, in the lake over time. This chapter describes how to estimate the amount of additional stormwater

phosphorus load to the lake, called phosphorus export that will be generated as a result of the project. It applies to commercial development projects and to subdivisions involving new road construction or expansion, or having more than five lots.



A lake's watershed boundary is dictated by local topography, generally following ridgelines or high points as shown by the shading above. Precipitation that falls within the watershed and is not evapotranspired reaches the lake as groundwater or stormwater runoff. The watershed and lake characteristics dictate the potential for increased phosphorus and algae in the lake over time.

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2.1 Watershed Per Acre Phosphorus Allocation

The Department of Environmental Protection (DEP) has considered all of the factors described above in developing phosphorus budgets for the watershed of each lake. Each budget is based on how much additional phosphorus loading the lake could accept without risking a perceivable change in the lake's water quality. It then distributes this additional phosphorus load amongst anticipated new development sources in the lake's watershed on a per acre basis. The per acre phosphorus allocation (referred to as "P") defines how much phosphorus each acre of land in a lake's watershed is allowed to discharge in stormwater runoff when developed.

If a lake's watershed is located within more than one town, the value of P may vary slightly for each town, depending on its anticipated rate of growth. The process used to define watershed phosphorus budgets is presented in Appendix B.

For large subdivisions and commercial developments (Chapter 3), P defines the average amount by which a development may increase the annual stormwater phosphorus exported to the lake from each acre of the parcel being developed.

For small projects, such as single family residences and additions to existing development (Chapter 6), the budget simply defines the type and size of phosphorus runoff controls, such as wooded buffers, which should be applied.

Phosphorus allocation values range from about 0.02 lb/acre/year for very sensitive lakes in high growth areas to 0.15 lb/acre/year for less sensitive lakes in very low growth areas.

P = Per Acre Phosphorus Allocation (lb/acre/year) = the watershed specific amount of stormwater phosphorus each acre of land within a parcel that is being developed is allowed to export annually. This is calculated by the DEP for selected Maine lakes as presented in Appendix C.

If a P for a lake/town combination is not listed or if you have information that suggests the P for a lake should be higher or lower than that presented in Appendix C, contact DEP's Division of Watershed Management.

2.2 Project Phosphorus Budget (PPB)

A project's phosphorus budget (PPB) is the maximum amount of algal available phosphorus, which in a typical year, may be exported from the new development. Algal available phosphorus refers to that portion of phosphorus the

stormwater runoff transports which can support algae growth in the lake. Typically about half of the total amount of phosphorus becomes available for algal growth.

PPB = Project's Phosphorus Budget = maximum amount of algal available phosphorus, which in a typical year, may be exported from the new development's parcel.

To calculate the PPB, multiply the acreage of developable land in the project parcel by the per acre phosphorus budget for the lake.

The developable land area includes all land within the parcel's boundaries except for NWI (National Wetlands Inventory) mapped wetlands over an acre in size and areas of sustained slope greater than 25% that are over one acre in size.

All areas need to be in acres to the second decimal place.

Use Worksheet 1 in Appendix D for calculating project phosphorus budgets.

Example 1: PPB Calculation for Subdivision Development

Problem:

'Homesweet Home Subdivision' is proposing a 12-lot subdivision on 40 acres. There are four acres of NWI wetlands and 1 acre of steep slopes. Calculate the PPB.

Solution:

Use Worksheet 1 to calculate the PPB.

Worksheet 1 PPB Calculations			
Project Name:	Homesweet Home Subdivision		
Standard Calculations			
Watershed per acre phosphorus allocation (Appendix C):	P	0.057	lbs/acre/year
Total acreage of development parcel	TA	40.00	acres
Existing impervious area (Pre 1980)	EIA _B	0.00	acres
Existing impervious area (post 1980)	EIA _A	0.00	acres
NWI wetland acreage:		4.00	acres
Steep slope acreage:	SA	1.00	acres
Project acreage: $A = TA - (WA + SA + EIA_B + EIA_A)$	A	35.00	acres
Project Phosphorus Budget: $PPB = P \times A$	PPB	1.995	lbs P/yr

Based on these calculations, the PPB is 1.995 lbs P/year.

Special Considerations

Alternative method for small commercial-type development located within designated growth areas.

It can be difficult for densely developed projects on small parcels to meet their phosphorus budgets. Because of the density of high phosphorus producing surfaces like parking lots and lawns, the stormwater draining these projects carries relatively large amounts of phosphorus. The small parcel size, however, means that the phosphorus budget for the parcel will also be small. As a result, highly intensive phosphorus control measures, which are often fairly costly, may be required for the project to meet its phosphorus budget.

In these cases it may cost less to develop outside the designated growth area where land is more readily available for larger parcel sizes (and hence larger project phosphorus budgets) and for less intensive, and less expensive, phosphorus control measures like natural wooded buffers. If a municipality is concerned that the phosphorus budget will counter local planning efforts by being a disincentive for locating development within designated growth areas, they may

request that the department allow commercial developers within their designated growth areas to use an alternative means of defining the project phosphorus budget. This alternative is described in Appendix E.

Project phosphorus budgets for large projects located within relatively small watersheds.

If a particularly large project is proposed in a relatively small watershed, there is a chance that the project's phosphorus budget may, by itself, use up most of, or even exceed, the watershed's total phosphorus budget, leaving little or no room for additional development within the watershed. In order to avoid this problem, an alternative method for calculating the project phosphorus budget for such projects is provided in Worksheet 1 under Small Watershed Adjustment. For each lake, DEP has identified the parcel size that would trigger use of this alternative method, called the small watershed threshold. If a project's parcel size exceeds the small watershed threshold (SWT) acreage given for each lake in the list of per acre phosphorus budgets in Appendix C, the PPB should be calculated using the Small Watershed Adjustment calculations in Worksheet 1.